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10/507035
DT15 Rec'd PCT/PTO 07 SEP 2004

[10537/283]

VEHICLE SEATING HAVING A LOWER LEG SUPPORT

The invention relates to a vehicle seat according to the features of the preamble of claim 1.

German utility model G92 00 777.5 discloses a bus seat with a footrest. The footrest is coupled to the seat cushion of the bus seat via a parallelogram linkage. A pneumatic spring interacts with the parallelogram linkage in order to fold the footrest from a stowaway position arranged underneath the seat cushion into a position of use.

DE 39 10 778 C2 discloses a control device for the backrest of a seat. The control device controls an actuator device which adjusts the inclination of the backrest of a seat. This control device detects an obstacle as the backrest of the seat inclines, it stops the inclination movement of the backrest of the seat.

The object of the present invention is to provide a vehicle seat with an adjustable lower leg support which is of compact design, has a comfortable sitting position and is easy and safe to operate. In particular, the vehicle seat is intended to have a high degree of protection against incorrect operation.

This object is achieved according to the invention by means of a vehicle seat according to the features of claim 1.

The lower leg support of the vehicle seat has an automatic drive. A control device with a sensor is connected to the drive in order to control the lower leg support. The sensor is designed to detect an obstacle. As a result, trapping

and/or damage and/or the risk of injury as the lower leg support is automatically adjusted, or when incorrect operation is carried out, is at least partially reduced or entirely prevented.

The drive is designed to adjust the lower leg support automatically, preferably in an infinitely variable fashion, preferably in order to displace the lower leg support from a space-saving stowaway position into a position of use and/or from a position of use into the stowaway position. It is also possible to adjust and/or set the sitting position as desired using the drive. The stowaway position is arranged lying closely against the seat so the vehicle seat takes up as little overall space as possible. The control device is preferably designed in such a way that it detects the stowaway position of the lower leg support as a zero position, which serves as the reference position for determining the travel of the lower leg support. In the position of use, the lower leg support is pivoted into the foot well and forms a comfortable rest and/or support for the lower legs and/or the feet of the sitting person. The control device calculates the position of the lower leg support in the position of use by means of the pivoting angle and/or the displacement travel.

In one embodiment, the lower leg support is pivoted by the drive about a pivot axis which extends transversely with respect to the vehicle seat. In addition, the length of the lower leg support can be varied, in particular, the area on which the lower legs rest can be increased by lengthening the lower leg support. During this adjustment process, the lower leg support may strike an obstacle, for example, a piece of luggage or the feet of a sitting person. In order to prevent the obstacle becoming trapped, and/or the lower

leg support and/or the obstacle being damaged, the sensor is arranged at the free end of the lower leg support.

The sensor may be embodied as a proximity sensor, preferably an inductive or capacitive proximity sensor and/or as a pressure sensor, preferably as a piezoelement and/or switch panel. When an obstacle is struck and/or detected, the sensor transmits a signal to the control device.

In one embodiment, provision is made for the control device to stop the drive if the sensor detects an obstacle. However, it is also possible for the control device to stop the drive and/or at least partially reverse it in order to prevent the lower leg support and/or the obstacle from being trapped and/or damaged.

The sensor can also be designed to determine the maximum possible displacement travel of the lower leg support. For this purpose, by actuating the drive, the control device moves the lower leg support out until it arrives at a limit position, i.e. abutting against installations in the vehicle or seats. The sensor detects this limit position so that the control device can detect and/or store the maximum possible adjustment travel of the lower leg support. As a result, in particular, tolerances between the arrangements in the vehicle or installations in the vehicle and the displacement travel and/or the dimensions of the lower leg support can be sensed and compensated for. The sensor detects the set position with the largest possible displacement travel and thus limits the displacement travel in this limit position.

It is possible to use the vehicle seat according to the invention in passenger cars, buses and watercraft or rail vehicles. The vehicle seat according to the invention can

also be provided as a comfortable passenger seat in aircraft.

Further features and embodiments of the invention emerge from the subclaims, the figures and the description of the figures. The features and feature combinations which are mentioned above and specified below can be used not only in the respectively stated combination but also in other combinations or alone, without departing from the scope of the invention.

Further embodiments of the invention are explained and illustrated in the figures, in which:

figure 1: is a view of the vehicle seat with the lower leg support in a position of use,

figure 2: is a sectional view of the lower leg support in a stowaway position,

figure 3: is a schematic view of the design of the lower leg support, and

figure 4: is a sectional view of the sensor.

Figure 1 shows a vehicle seat 1. It has a backrest 11 with headrest 12 and a seat cushion 2 with lower leg support 3. The vehicle seat 1 is displaceably mounted by means of rails 14 in a vehicle, for example, in the rear of a passenger car. A seatbelt mount 13 for a three-point belt is integrated into the backrest 11. The backrest 11 and the seat cushion 2 each have an upholstered element with a covering material, for example, leather. The upholstered element 21 upholsters the seat cushion 2 and the lower leg support 3 and is of continuous design. It forms, on its

upper side, a coherent, upholstered sitting surface which extends from the seat cushion 2 as far as the lower leg support 3.

The lower leg support 3 is extended forward in the position of rest or position of use which is illustrated in figure 1. It has been pivoted up in the forward direction and extended in order to enlarge its resting surface for the lower legs. The lower leg support 3 has a three-component telescopic component with an upper telescopic element 32, a central telescopic element 33 and a lower telescopic element 34. In order to vary the length of the lower leg support 3, the telescopic elements 32, 33 and 34 can be adjusted in a telescopic fashion by means of an electric drive 5. A footrest 4 is arranged at the lower end of the lower leg support 3. It is connected to the lower telescopic element 34 and has a footplate 41 which is mounted on a crossmember 42 and which is folded out into the position of use and provides a comfortable support for the feet. The footplate 41 can be pivoted about an axis of rotation which extends transversely with respect to the lower leg support 3, and in the position of use it is approximately perpendicular to the lower leg support 3. One end of the lower leg support 3 is connected to the seat cushion 2. The inclination of the lower leg support 3 in relation to the seat cushion 2 can be set by means of an inclination adjuster 35 with an electric drive motor. The other end of the lower leg support is freely displaceable and supports the footrest 4. A sensor 6 for detecting obstacles in the displacement path of the lower leg support 3 is arranged at the free end.

The vehicle seat 1 has both the position of rest or lying position illustrated in figure 1 and further sitting positions, preferably also an upright sitting position with retracted lower leg support 3 and a folded-in footrest 4.

The stowaway position with retracted lower leg support 3 and folded-in footrest 4 is shown in figure 2. The telescopic elements 32, 33 and 34 of the lower leg support 3 are pushed one into the other and are arranged pointing approximately vertically downward at the front end of the seat cushion 2. An inclination adjuster 35, which connects the lower leg support 3 to the seat cushion 2, is arranged on the upper telescopic element 32. The inclination adjuster 35 has an electric motor for adjusting the inclination of the lower leg support 3.

The footplate 41 is arranged in parallel with the lower leg support 3 and forms, together with the seat upholstered element 21, a planar front surface which closes off the vehicle seat from the front. The rear of the footplate 41 is flush with the upper side of the seat upholstered element 21 so that the vehicle seat does not have any protruding edges and/or the footplate 41 cannot be inadvertently folded forward. In the stowaway position, the lower leg support 3 and the footrest 4 are arranged resting against the front region of the seat cushion 2. This stowaway position saves space and does not adversely affect the amount of foot space available in the vehicle.

The sensor 6 is arranged at the lower end of the lower leg support 3 and has two sensor surfaces 61, 62. The first sensor surface is arranged on the end side of the lower leg support 3 and is designed to detect obstacles which lie in its displacement path when the lower leg support 3 extends in a linear fashion. The second sensor surface 62 is arranged at the rear of the lower leg support 3, i.e. on the side facing away from the lower leg support surface. It is designed to detect obstacles which lie in the displacement path when the lower leg support 3 is pivoted.

Figure 3 shows the schematic design of lower leg support 3 with drive 5. The drive 5 is embodied as a spindle drive and has an electric drive motor 51 which drives a first spindle drive 56 and a second spindle drive 57. The drive 5 is connected via a bridge to the central telescopic element 33. The first spindle drive 56 engages between the central telescopic element 33 and the upper telescopic element 32, and the second spindle drive 57 engages between the central telescopic element 33 and the lower telescopic element 34. The upper telescopic element 32 and the lower telescopic element 34 are moved synchronously away from the central telescopic element 33 or toward the central telescopic element 33 via the spindle drive 56, 57.

The electric drive motor 51 drives the first spindle drive 56 and the second spindle drive 57 in opposite directions by means of a gear mechanism. As a result, the electric motor 51 drives the telescopic elements 32, 33, 34 in such a way that, in one sense of rotation, the upper telescopic element 32 and the lower telescopic element 34 are driven away from the central telescopic element 33, and in the opposite sense of rotation, the upper telescopic element 32 and the lower telescopic element 34 are driven toward the central telescopic element 33.

The drive motor 51 is connected to a control device 52. The control device 52 controls the drive motor 51 and/or the inclination adjuster 35 and thus the movement sequence of the lower leg support 3. The control device 51 is connected to the sensor 6 in order to detect obstacles, said sensor 6 being arranged at the lower end of the lower leg support 3. The control device 52 is connected via cables to the sensor 6 and in addition to the drive motor 51 and the inclination adjuster 35. In addition, the control device 52 has a power feed line. A cable guide 53 which is connected to the

central telescopic element 33 prevents the cables becoming entangled and/or damaged when the lower leg support 3 moves. The cable guide 53 has a spring-loaded cable drum which automatically retracts or unrolls the guided cables. The cable guide 53 therefore takes up the cable slack and keeps the cables taut so that the cables are prevented from becoming entangled and/or flapping around.

If the sensor 6 detects an obstacle, it transmits a signal to the control device 62. The latter then stops the movement of the lower leg support 3 and moves it back a certain amount in order to prevent the obstacle from becoming trapped and/or being damaged.

Figure 4 illustrates the sensor 6. It is arranged on the crossmember 42 of the lower telescopic element 34. A first sensor surface 61 is arranged on the end surface and a second sensor surface 62 is arranged at the rear of the crossmember 42. The sensor surfaces 61, 62 extend over a large part of the width of the lower leg support 3 and are embodied as pressure-sensitive switch panels.

The sensor 6 has an electrically conductive contact film 65 which is connected in a planar fashion to the crossmember 42 via an insulator 64. An electrically conductive connecting strip 66 is arranged over foam inlays 67 which are embodied as spacing elements and are at a distance from the contact strip 65. If pressure is exerted on the connecting strip 66, the foam inlay 67 is pushed over and the connecting strip 66 moves into electrically conductive contact with the contact strip 65.

An elastic rubber strip 63 covers the first switching surface 61 and the second switching surface 62. The rubber strip 63 is clipped to the crossmember 42 and secures the

sensor 6 so that it rests directly on the crossmember 42. The rubber strip is connected to the sensor 6 so that, in order to replace the sensor 6, only the rubber strip 63 with sensor 6 has to be replaced.

The elasticity of the rubber strip 63 is to be dimensioned in such a way that, when there is contact with an obstacle, it distributes the pressure which occurs between the first sensor surface 61 and the second sensor surface 62. As a result, the obstacle is reliably detected even if the obstacle does not directly strike the first sensor surface 61 or the second sensor surface 62.

In the stowaway position, the sensor 6 abuts against the vehicle seat 1. As a result, the sensor 6 detects the home position of the lower leg support 3. The home position thus serves as a reference position for the control device 52, from which position it determines the position of the lower leg support over the displacement travel. In order to compensate for tolerances, the control device can determine the limit position of the lower leg support 3 by moving out the lower leg support to a maximum extent until the lower leg support moves into contact with installations in the vehicle, and the sensor 6 signals the limit position. The sensor 6 detects the maximum possible displacement position and thus limits the maximum possible displacement travel of the lower leg support 3.